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振动干燥机

The Vibration Dryer



上海森永工程设备股份有限公司

Shanghai Nagamori Machinery Co., Ltd.

一种独特的振动干燥机，仅通过振动使粉末和颗粒流化，并通过间接加热进行干燥

适用于各种条件和应用范围

V-Dryer Series Applicable to

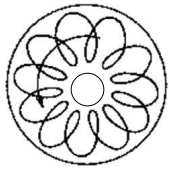
Our original vibration dryers that can fluidize, indirectly heat and dry powder and granular materials only by means of vibration

VU型流态化模型

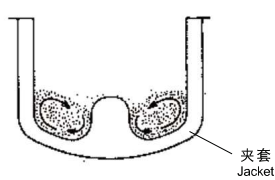
Fluidization pattern of Model VU

VU适用于中小量、批次式的物料干燥，适合在干燥过程中物料材质、性质、体积发生较大变化的场景。

Model VU is suitable for the batch type processing of small to medium volume of materials, where the materials are various and their physical properties, charging volume, etc. largely vary as drying progresses.



从上方观察粉末的运动
Powder flow viewed from top



从横截面看粉末的运动
Powder flow viewed cross-sectionally

VH型流态化模型

Fluidization pattern of Model VH

VH型适用于中大量、低含量物料干燥，当装料量为干燥机本体容量的60-80%时，将会展现出稳定规律的流动，但流动状态会随着装料量减少而变差。

Model VH is suitable for the processing of medium to large volume with low liquid content, where charging volume is 60-80% of the dryer body capacity showing stable fluidity and the fluidity tends to be worsened when the volume is reduced.



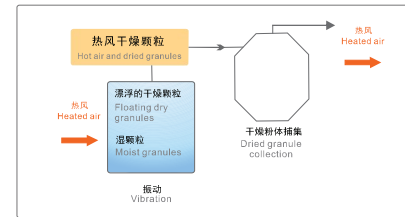
从横截面看粉末的运动
Powder flow viewed cross-sectionally

纳米颗粒的干燥

Drying of nano-granules

振动干燥机振动粉体使其分散，通过夹套加热，干燥纳米颗粒。同时送入热空气。通过吹空气，可以使纳米颗粒悬浮在罐内，并且可以通过单独的集尘器收集这些悬浮的纳米颗粒并干燥成类似于初级颗粒的粉末形式。

流程图 Flow chart



干燥从浆料到糊状的各种材料

Drying of widely ranging material forms slurry to paste

在振动干燥机中，浆料原料被放入干燥机中而不被移除。这使得处理各种工艺成为可能。

- 对固体、液体难以分散的原料进行干燥；
- 对液体中溶解的成分不希望脱液的原料进行干燥；
- 希望防止异物混入的原料进行干燥



块状

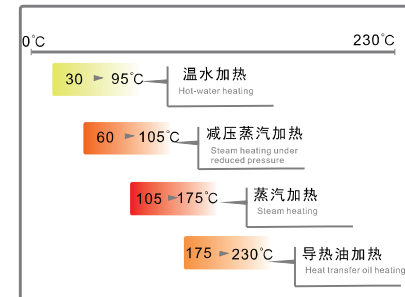
浆料

从低温到高温的干燥

Drying at low temperature to high temperature

振动干燥机可以在30度至230度的较宽温度范围内干燥。对于高温，可采用蒸汽加热或其他热介质加热。

振动干燥机加热范围 Heatable range of vibration dryers

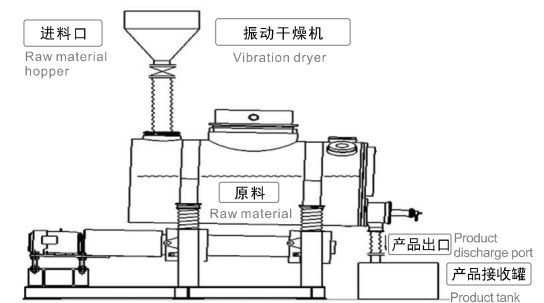


非常适合自动化

Optimum for automation

由于振动干燥机内的原料处于流体状态，可以自动进入下一工序，通过连接自动上下料设备可以实现自动化。

流程图 Flow chart



| | |
|-------------------------|--|
| 无机物 Inorganic matter | 磨料、玻璃珠、石墨、碳、无机盐等各种无机化学品 碳化硅/空心硅/二氧化硅/氟化钾/玻璃/玻璃浆/石灰污泥/钛酸钡 Various inorganic chemicals, such as abrasives, glass beads, black lead, carbon and inorganic salt Silicon carbide/hollow silica/silica/potassium fluoride/glass/glass slurry/lime oversludge/barium titanate/zirconia/lithium fluoride/sericite/neodymium |
| 树脂 Resin | 离子交换树脂 酚醛树脂 丙烯酸树脂/PVC树脂/聚酯树脂 合成树脂/特氟龙珠/树脂颗粒/聚酯切片/高分子树脂 Ion-exchange resin, phenol resin, acrylic resin, Polyvinyl chloride resin, polyethylene resin Synthetic resin/teflon beads/resin pellets/polyester chips/polymer resin |
| 其它 Others | 电子材料/照相原料/橡胶助剂/硅加工废水/记录材料/光刻胶/荧光物质/密封剂/粘合剂/催化剂 Electronic materials/photographic raw materials/rubber chemicals/silicon processing effluent/recording materials/photoresist/fluorescence substances/sealant/adhesive/catalyst |

适用于各种条件和应用范围

Various Conditions and uses

异物难以进入

Preventing the invasion of foreign matter

与搅拌旋转干燥机相比，振动干燥机没有搅拌叶片或旋转物体。可以防止异物进入。

构造 Structure

振动干燥机，立式和卧式均内部结构简单，无凹凸，可防止污染。符合GMP标准。

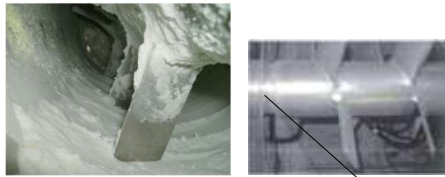


▶ VU型 内部

▶ VH型 内部

污染原因 Cause of contamination

在搅拌器/旋转式干燥机中，旋转部分位于干燥机内部，清洁轴封需要时间。如果搅拌叶片旋转，粉末可能会附着在叶片上，导致密封件污染。



▶ 原料附着

▶ 轴封部位

含有有机溶剂的原料干燥

Drying at raw materials containing organic solvents

易于清洁

Easy to clean

与旋转式相比，内部无凹凸，简单易清洁，开口较大，开闭方便。



▶ 擦净后的状态

▶ 关闭后的状态

减少罐体磨损

Reduced wear of can body

振动引起的流化使得粉末在釜体内壁漂浮流动，因而可以减少釜体磨损。为了防止污染（异物），我们还可以使用聚四氟乙烯涂层和哈氏合金等特殊材料制造釜体。



▶ 特氟龙涂层

可内衬材料
聚四氟乙烯
(PFA/PTFE/高温涂层)

防止发生健康问题

• 由于原料在密闭空间干燥，因此可以防止不良气味和健康问题。

可安装的区域

• 通过安装防爆电机，可以安装在危险程度较高的防爆区域。

溶剂回收

• 由于在密闭空间中干燥，因此可以回收有机溶剂等，这也有助于解决环境问题。

间歇式振动干燥机

VU型

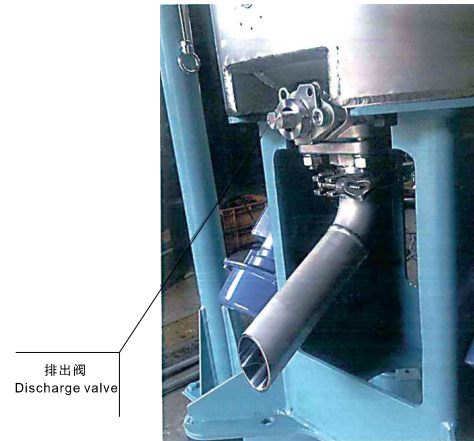
Vibration Dryer Batch Type Model VU

VU型干燥机机身的整个表面均附有夹套，并由4个弹簧支撑。运动机构是将两个振动电机安装在主机两侧，产生斜向上的半椭圆形振动。从干燥机机体底部施加振动，机体内部的粉体沿径向上下流动，同时沿圆围方向旋转，同时干燥和制粉。此外，VU型对干燥物料量和干燥的粉体性质覆盖范围广，操作方便。

A rigid and overall jacket is provided on the dryer body of model VU which is supported by four springs. The vibrating mechanism with two vibration motors generates elliptical vibration motor in sloping radial direction. The vibration is applied from the bottom of the dryer body and the granules in it will be fluidized moving up and down in radial direction while circulating along the wall, thus the drying and mixing of granules can be performed at the same time. Model VU is adaptable to wide range of variation in volume of material to be dried and properties of materials and can be operated easily.



▶ VU-135型。特殊规格（带不锈钢电机盖）
Special specifications (All SUS with motor cover) Model VU-135



▶ 排出阀
Discharge valve

▶ VU型卸料口 Discharge port of Model VU
边振动边排出粉末
The port discharges granules while vibrating



▶ 干燥机内部 Dryer body inside

▶ 排出口
Discharge port

▶ 温度传感器
Temperature measuring
resistive element

间歇式振动干燥机 VH型

Vibration Dryer Batch Type Model VH

VH型号的卧式釜体由弹簧支撑，釜体底部有起振装置，通过圆周运动产生环形振动，因此粉体颗粒主要是在圆周方向往复运动。

VH型号是VHC连续化干燥机，以及VE振动蒸发器的原型。

Model VH has a vibrating device under the horizontal dryer body supported by springs. It generates circular vibration in circumferential direction. Thus, the granules mainly move up and down on the circumference.

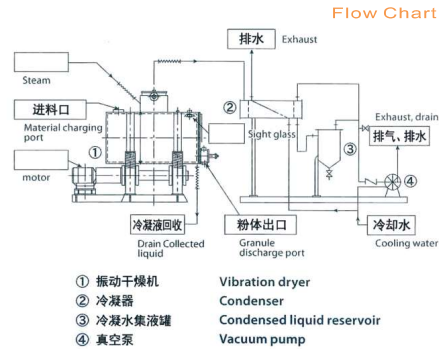
Model VH is a prototype for continuous Model VHC and vibrating evaporator Model VE.



▶ VH-120x480型 Model VH-120x480



▶ 滤袋过滤器盖板回旋装置（可选） Fabric filter cover rotor (option)



▶ VH-100型 Model VH-100

热电阻测温元件
Temperature measuring resistive element

▶ 干燥机内部经过抛光处理
Dryer inside finished by buffing (#250)

间歇式振动干燥机 VHS型

Vibration Dryer Batch Type Model VHS

当使用振动干燥机干燥糊状的陶瓷、金属粉体或其浆料时，最终可能会得到从微米级别细粉到毫米级别颗粒的混合物。VHS型号在釜体内设有格栅，并装有研磨球等介质，在加热干燥的同时，用泵定量输入浆料，并同时干燥和粉碎操作。

该型号有半连续式和间歇式两种形式，前者为连续进料，间歇出料；根据物料性质，可精确控制粉碎和干燥时间。后者是研磨介质与待干燥物料一次性同时进料。

该型号干燥机面对近年来日益加大的细粉生产需求，对陶瓷、磨料、金属粉末的干燥展现出高度适应性。



对于不同粉碎目标，有多种形式和形状的研磨介质可供选择：如氧化铝球、尼龙包覆MCN球等。

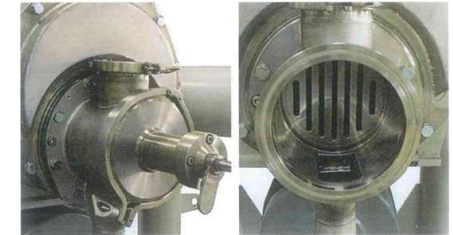
Grinding media with suitable characteristics and shape for the purpose are selected: alumina balls, nylon coated MCN balls, etc.

When ceramics or metal powder in a state of slurry or paste is dried in the Vibration Dryer, drying may be completed on the material in a state of mixture of its various different sizes from one micron fine powder up to granules in several millimeters.

Model VHS with slitted plate in the dryer and grinding balls or other media charged in it feeds a fixed amount of slurry with a pump while heating it, and carries out the drying and grinding operations at the same time.

Semi-continuous operation mode and batch type operation mode are available. In the former, material is continuously fed and discharged in batches to control the grinding and drying time depending upon materials to be dried. In the latter, material to be dried and grinding media are charged together at the same time.

This model is the most suitable dryer to dry ceramics, abrasives and metal powder which has been increasingly required to be fine-powdered in recent years.



▶ 带格栅的排出阀 Discharge valve with slits

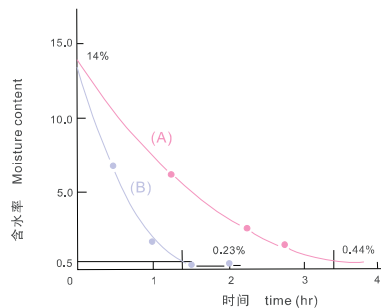


常压和减压干燥时间比较

Drying time comparison between "Normal pressure" and "Reduced pressure"

有机药品常压/减压操作时的干燥曲线

-----Drying curve of organic chemicals in working at normal pressure and reduced pressures



| 有机药品 Organic chemical | 14%→0.5% (D. B.) | |
|--------------------------|--------------------|--------------------|
| | (A) | (B) |
| 操作压力 | 101.3kPa (760Torr) | 19.9kPa (150Torr) |
| 加热温度 | 140°C | 140°C |
| 装料量 | 10kg | 10kg |
| 有效传热面 | 0.26m ² | 0.26m ² |

时间

干燥能力比较

Drying ability comparison

振动干燥机 ----- Vibration dryer

锥型干燥机

----- Conical dryer

| | |
|--|---|
| 水分 | 39.5wt%→1.8wt% |
| 时间 | 1.5hr |
| 加热源 Heating source(steam) | 0.1MPa 120°C |
| 原料投入 Raw material charging amount | 8.7kg(15.8l) |
| 操作压力 Working pressure | 6kPa(45Torr) |
| 有效传热面积 Effective heat-transfer area | 0.28m ² |
| 总传热系数 Total heat-transfer coefficient | U=73.2w/m ² .K(63kcal·m ⁻² ·h ⁻¹ ·°C ⁻¹) |

| | |
|--|---|
| 水分 | 37.6wt%→1.8wt% |
| 时间 | 2.9hr |
| 加热源 | 0.1MPa 120°C |
| 原料投入 Raw material charging | 7kg(12.7l) |
| 操作压力 | 5.3kPa→3.3kPa 平均 (Average) 4.6kPa 40Torr→25Torr 平均 (Average) 35Torr |
| 有效传热面积 Effective heat-transfer | 0.23m ² |
| 总传热系数 Total heat-transfer coefficient | U=34.8w/m ² .K(30kcal·m ⁻² ·h ⁻¹ ·°C ⁻¹) |

使用条件
Terms of uses 原料：树脂化合物、粒径：0.3mm、珠状堆
密度：原料时 0.55g/cm³、产品时 0.45g/cm³

Raw material: Resin polymer substance, 0.3mm, bead-like
Bulk specific gravity: Raw material state 0.55, product state 0.45

特殊规格

Special Specifications



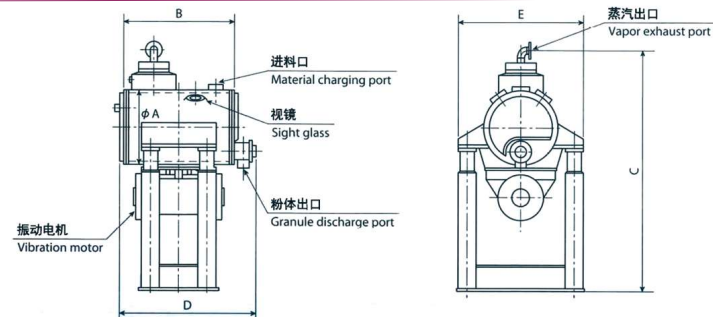
▶ 加热、冷却用管道 Heating / Cooling Pipe

▶ 传动盖 (油嘴) Drive joint cover(Grease nipple)

▶ 空气弹簧 Air spring

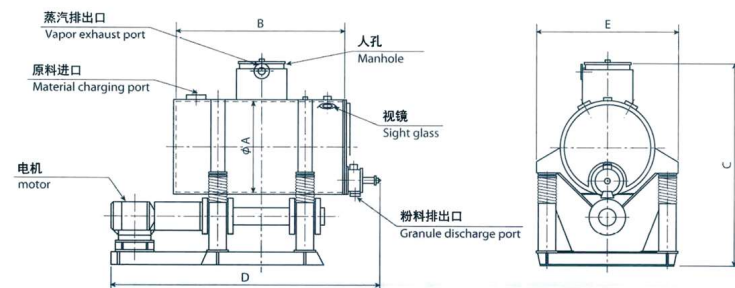
VH Model VH

VH25-50



| 型号 Model | 容积 Capacity(L) | 全容积 Volume (L) | 主要尺寸 Dimension (mm) | | | | | 重量 Weight (kg) | 排气口直径 Exhaust size (A) | 排料口直径 Discharge size(A) | 电动机 (2台/1设备) Motor (2 unit/1group) | |
|-------------|-------------------|-------------------|---------------------|-----|------|------|------|-------------------|---------------------------|----------------------------|---------------------------------------|-----------|
| | | | A | B | C | D | E | | | | 50Hz | 60Hz |
| VH-25 | 15 | 25 | 250 | 500 | 1200 | 730 | 650 | 400 | 25 | 50 | 0.6kW×4P | 0.6kW×6P |
| VH-30 | 27 | 45 | 310 | 600 | 1600 | 900 | 800 | 400 | 25 | 50 | 0.85kW×4P | 0.85kW×6P |
| VH-40 | 60 | 100 | 400 | 800 | 1650 | 1250 | 950 | 900 | 32 | 50 | 1.5kW×4P | 1.6kW×6P |
| VH-50 | 100 | 168 | 475 | 950 | 1800 | 1300 | 1000 | 950 | 40 | 60 | 1.5kW×4P | 1.6kW×6P |

VH60-120



| 型号 Model | 容积 Capacity(L) | 全容积 Volume (L) | 主要尺寸 Dimension (mm) | | | | | 重量 Weight (kg) | 排气口直径 Exhaust size (A) | 排料口直径 Discharge size(A) | 电动机 (1台/1设备) Motor (1 unit/1group) | |
|------------------------------|-------------------|-------------------|---------------------|--------------------------------|--------------------------|---------------------------|------------------|-------------------|---|----------------------------|---------------------------------------|----------|
| | | | A | B | C | D | E | | | | 50Hz | 60Hz |
| VH-60 | 203 | 339 | 600 | 1200 | 1900 | 2200 | 1200 | 1310 | 50 | 80 | 3.7kW×4P | 3.7kW×6P |
| VH-75 | 397 | 662 | 750 | 1500 | 2200 | 2800 | 1500 | 2100 | 65 | 150 | 5.5kW×4P | 5.5kW×6P |
| VH-90 | 687 | 1145 | 900 | 1800 | 2500 | 3200 | 1700 | 2550 | 80 | 150 | 7.5kW×4P | 7.5kW×6P |
| VH-100 | 942 | 1570 | 1000 | 2000 | 2600 | 3500 | 1900 | 3550 | 80 | 200 | 11kW×4P | 11kW×6P |
| VH-110 | 1254 | 2090 | 1100 | 2200 | 2900 | 3800 | 2000 | 4380 | 100 | 200 | 15kW×4P | 15kW×6P |
| VH-120 | 1628 | 2714 | 1200 | 2400 | 3100 | 4100 | 2100 | 5200 | 100 | 200 | 22kW×4P | 22kW×6P |
| VH-120×480 | 3250 | 5428 | 1200 | 4800 | 3500 | 6000 | 2200 | 12000 | 150×2 | 250 | 37kW×4P | 37kW×6P |
| 常用规格 Commin specification | | | 材质 Material | 流体名称 Fluid name | 使用压力 Working pressure | 设计压力 Designed pressure | 精加工 Finishing | 涂层 Coating | 配件 Accessory | | | |
| | | | 干燥机本体 Dryer body | SUS304 粉粒 Granules | Full Vacuum | -0.1MPa | 内表面抛光#250 | 涂层 2.5B/3 | 排放专用阀门、各种喷嘴、视镜、地脚螺栓、标准工具 nozzles, sight glass, anchor bolt, standard tools | | | |
| | | | 夹套 Jacket | Ss304 蒸汽/热水 Steam/Hot water | 0.19MPa | 0.19MPa | | | | | | |

标准规格

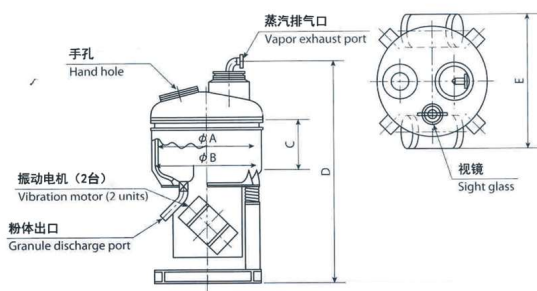
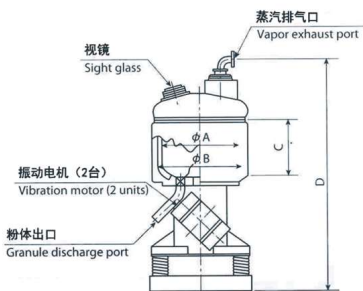
Standard specifications

VU

Model VU

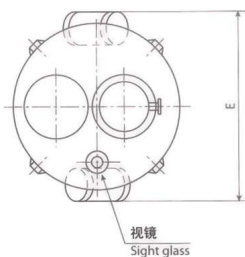
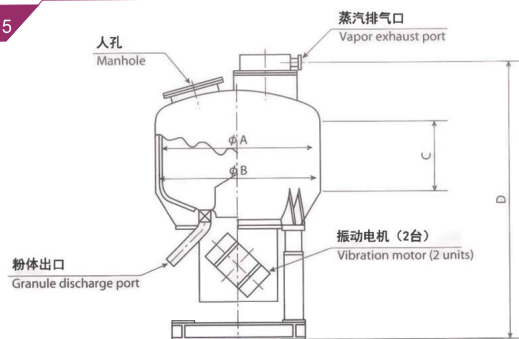
VU30-45

VU60-75



| 型号 Model | 容积 Capacity(L) | 全容积 Volume(L) | 主要尺寸 Dimension (mm) | | | | | 重量 Weight(kg) | 排气口直径 Exhaust size(A) | 排料口直径 Discharge size(A) | 电动机 (2台/1设备) Motor (2 unit/1group) | |
|-------------|-------------------|------------------|---------------------|-----|-----|------|------|------------------|--------------------------|----------------------------|---------------------------------------|-----------|
| | | | A | B | C | D | E | | | | 50Hz | 60Hz |
| VU-30 | 5 | 20 | 300 | 350 | 200 | 1100 | 620 | 130 | 20 | 40 | 0.13kW×4P | 0.13kW×6P |
| VU-45 | 15 | 60 | 450 | 450 | 250 | 1300 | 700 | 200 | 25 | 40 | 0.25kW×4P | 0.20kW×6P |
| VU-60 | 30 | 125 | 600 | 650 | 300 | 1500 | 900 | 450 | 32 | 50 | 0.40kW×4P | 0.35kW×6P |
| VU-75 | 60 | 240 | 750 | 800 | 350 | 1650 | 1100 | 800 | 40 | 50 | 0.85kW×4P | 0.85kW×6P |

VU95-195



| 型号 Model | 容积 Capacity(L) | 全容积 Volume(L) | 主要尺寸 Dimension (mm) | | | | | 重量 Weight(kg) | 排气口直径 Exhaust size(A) | 排料口直径 Discharge size(A) | 电动机 (2台/1设备) Motor (2 unit/1group) | |
|-------------|-------------------|------------------|---------------------|------|-----|------|------|------------------|--------------------------|----------------------------|---------------------------------------|----------|
| | | | A | B | C | D | E | | | | 50Hz | 60Hz |
| VU-95 | 120 | 450 | 950 | 1000 | 400 | 1900 | 1260 | 1100 | 40 | 65 | 1.1kW×4P | 1.1kW×6P |
| VU-135 | 300 | 1190 | 1350 | 1400 | 500 | 2500 | 1690 | 2000 | 50 | 80 | 1.5kW×4P | 1.6kW×6P |
| VU-160 | 500 | 1900 | 1600 | 1650 | 550 | 2750 | 1990 | 3200 | 65 | 100 | 2.2kW×4P | 2.2kW×6P |
| VU-195 | 1000 | 3200 | 1950 | 2000 | 550 | 3000 | 2400 | 4500 | 80 | 100 | 3.7kW×4P | 3.7kW×6P |

干燥数据示例

Examples of drying data

| | 有机染 | 有机化学品 | 合成树 | 合成树 | 黑色无机物 | 陶瓷 | 磨料 | 有色金属 | | 活性金属粉末 |
|--|--------------|-----------------------------|------------------|-----------------|----------------------|---------------------------------|-----------------|--|----------------|------------------------------|
| 原料形 | 块状粉 | 粉末 | 粉末 | 珠子 | 粉末 | 浆料 | 浆料 | 糊状物 | 砂状 | 浆料 |
| 溶剂 | 有机溶剂 | 水 | 水 | 水 | 水 | 水 | 水 | 水 | 水 | 有机溶 |
| 干燥前 | 30 | 10 | 27 | 40 | 80 | 40 | 20 | 69 | 6.1 | 58 |
| 干燥后 | 0.2 | 0.1 | 1.5 | 1.0 | 1.0 | 0.5 | 0.03 | 9 | 0 | 0 |
| 材料平 | max.50mm | — | 20μ | 200μ | 100μ | 1μ | 10μ | 几微米 | 150μ | 1μ |
| 材料比 | 0.65 | — | 0.37 | 0.55 | 0.5 | — | 2.1 | 0.93 | 5.3 | 0.6 |
| 使用机 | VH | VH | VH | VH | VU | VH | VU | VH | VH | VU |
| 热媒 | 水蒸气 | 热水 | 热水 | 水蒸气 | 水蒸气 | 水蒸气 | 水蒸气 | 水蒸气 | | 水蒸气 |
| 热媒温 | 130 | 86 | 60 | 130 | 125 | 138 | 130 | 150 | 130 | 110 |
| 操作压力 | 6.6 (50) | 24.6 (185) | 1.3-4 (10-30) | 0.6-6 (5-45) | 2.6-34.6 (20-260) | 101.3 (760) | 101.3 (760) | 101.3 (760) | 101.3 (760) | 54.6 (410) |
| 振动数 | 19.4 | 29.2 | 24.2 | 24.2 | 29.2 | 29.2 | 29.2 | 24.2 | 29.2 | 29.2 |
| 流动状 | 好 Good | 好 Good | 好 Good | 坏→好 Bad→Good | 好 Good | 坏→好 Bad→Good | 坏→好 Bad→Good | 坏→好 Bad→Good | 好 Good | 坏→好 Bad→Good |
| 附着状 | 无 | 无 | 静电附 | 静电附 | 无 | 微量 | 无 | 无 | 无 | 无 |
| 平均总传热系数 Mean overall heat transfer coefficient w/m.k(kcal/m ² ·hr·°C) | 69.7 (60) | 87.2 (75) | 69.7 (60) | 63.9 (55) | 157.0 (135) | 282.6 (243) | 314.0 (270) | 215.0 (185) | 465.2 (400) | 162.8 (140) |
| 备注 Remarks | | 惰性气体吹扫 Inert gas purging | — | 平均总传热系数是双 | 惰性气体吹扫, 冷 | 通过粉碎球磨 Grinding is performed | — | 通过粉碎球磨 Grinding is performed by loading balls | — | 冷却至室温后排出 Discharged after |

试验机

Testing machine

<试验机及标准原料装置> -----Test machine and standard raw material charging amount



▶ VH25型 Model VH-25

| 试验机 | 样式 | 型号 | 原料填充量 Raw material charging amount |
|---------------------------------------|------------------------------|-----------------------------------|---------------------------------------|
| 不锈钢试验机 SUS test machine | 批量式 Batch type | VU-15 | 1L |
| | | VU-30 | 5L |
| | | VU-45 | 15L |
| | | VH-20 | 7.5L |
| | | VH-25 | 15L |
| | 连续式 Sequencing batch type | VH-25(中间出料) (Center discharge) | 15.6L |
| PTEE内衬试验机 PTEE lining test machine | 批量式 | VH-20×80 | 15L |
| | | VU-30 | 5L |

辅助设备
Incidental equipment

溶剂回收装置 (冷凝器、集液罐、真空泵)
导热油装置

Solvent collector (condenser, receiving tank, vacuum pump)
Boiler equipment, heat medium equipment (applicable up to 230°C, chiller equipment).